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Specification and Drawings, as originally filed, with Application for Patent Serial No: **2,406,047**, on September 30, 2002, by **IDELIX SOFTWARE INC.**, assignee of Ali Solehdin, for "A Graphical User Interface for Digital Media and Network Portals Using Detail-in-Context Lenses".

Agent certificateur/Certifying Officer

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A GRAPHICAL USER INTERFACE FOR DIGITAL MEDIA AND NETWORK PORTALS USING DETAIL-IN-CONTEXT LENSES

The invention relates to the field of computer graphics processing, and more specifically to a graphical user interface using detail-in-context lenses for direct interaction with digital media and for interfacing with network portals.

BACKGROUND OF THE INVENTION

Display screens are the primary visual display interface to a computer. One problem with these visual display screens is that they are limited in size, thus presenting a challenge to user interface design, particularly when larger amounts of information is to be displayed. This problem is normally referred to as the "screen real estate problem".

Well-known solutions to this problem include panning, zooming, scrolling or combinations thereof. While these solutions are suitable for a large number of visual display applications, these solutions become less effective where the visual information is spatially related, such as maps, newspapers and such like. In this type of information display, panning, zooming and/or scrolling is not as effective as much of the context of the panned, zoomed or scrolled display is hidden.

A recent solution to this problem is the application of "detail-in-context" presentation techniques. Detail-in-context is the magnification of a particular region of interest (the "focal region" or "detail") in a data presentation while preserving visibility of the surrounding information (the "context"). This technique has applicability to the display of large surface area media, such as maps, on limited size computer screens including laptop computers, personal digital assistants ("PDAs"), and cell phones.

In the detail-in-context discourse, differentiation is often made between the terms "representation" and "presentation". A representation is a formal system, or mapping, for specifying raw information or data that is stored in a computer or data processing system. For example, a digital map of a city is a representation of raw data including street names and the relative geographic location of streets and utilities. Such a representation may be displayed visually on a computer screen or printed on paper. On the other hand, a presentation is a spatial

organization of a given representation that is appropriate for the task at hand. Thus, a presentation of a representation organizes such things as the point of view and the relative emphasis of different parts or regions of the representation. For example, a digital map of a city may be presented with a region magnified to reveal street names.

In general, a detail-in-context presentation may be considered as a distorted view (or distortion) of a portion of the original representation where the distortion is the result of the application of a "lens" like distortion function to the original representation. A detailed review of various detail-in-context presentation techniques such as Elastic Presentation Space may be found in a publication by Marianne S. T. Carpendale, entitled "A Framework for Elastic Presentation Space" (Carpendale, Marianne S. T., *A Framework for Elastic Presentation Space* (Burnaby, British Columbia: Simon Fraser University, 1999)), and incorporated herein by reference.

In general, detail-in-context data presentations are characterized by magnification of areas of an image where detail is desired, in combination with compression of a restricted range of areas of the remaining information (i.e. the context), the result typically giving the appearance of a lens having been applied to the display surface. Using the techniques described by Carpendale, points in a representation are displaced in three dimensions and a perspective projection is used to display the points on a two-dimensional presentation display. In detail-in-context presentation systems, when a lens is applied to a two-dimensional continuous surface representation, for example, the resulting presentation appears to be three-dimensional. In other words, the lens transformation appears to have stretched the continuous surface in a third dimension.

One shortcoming of present graphical user interfaces for interaction with digital media and for interfacing with network portals is that they do not allow for effective user control of detail-in-context presentations.

A need therefore exists for a graphical user interface for digital media and for interfacing with network portals that allows for effective user control of detail-in-context presentations. Consequently, it is an object of the present invention to obviate or mitigate at least some of the above mentioned disadvantages.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention may best be understood by referring to the following description and accompanying drawings. In the description and drawings, line numerals refer to like structures or processes. In the drawings:

FIG. 1 is a graphical representation of the geometry for constructing a three-dimensional (3D) perspective viewing frustum, relative to an x, y, z coordinate system, in accordance with known elastic presentation space graphics technology;

FIG. 2 is a graphical representation of the geometry of a presentation in accordance with known elastic presentation space graphics technology;

FIG. 3 is a block diagram illustrating an exemplary data processing system for implementing an embodiment of the invention;

FIG. 4 is a screen capture illustrating a detail-in-context lens applied to a celebrity's wrist watch in the context of a television program in accordance with an embodiment of the invention;

FIG. 5 is a screen capture illustrating a lens applied to advertisements in a video game in accordance with an embodiment of the invention; and,

FIG. 6 is a screen capture illustrating the application of lenses in multi-player video games in accordance with an embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the following description, numerous specific details are set forth to provide a thorough understanding of the invention. However, it is understood that the invention may be practiced without these specific details. In other instances, well-known software, circuits, structures and techniques have not been described or shown in detail in order not to obscure the invention. In the drawings, like numerals refer to like structures or processes.

The term "data processing system" is used herein to refer to any machine for processing data, including the computer systems and network arrangements described herein. The term "Elastic

Presentation Space" ("EPS") (or "Pliable Display Technology" ("PDT")) is used herein to refer to techniques that allow for the adjustment of a visual presentation without interfering with the information content of the representation. The adjective "elastic" is included in the term as it implies the capability of stretching and deformation and subsequent return to an original shape. EPS graphics technology is described by Carpendale in "A Framework for Elastic Presentation Space" (Carpendale, Marianne S. T., *A Framework for Elastic Presentation Space* (Burnaby, British Columbia: Simon Fraser University, 1999)), which is incorporated herein by reference. In EPS graphics technology, a two-dimensional visual representation is placed onto a surface; this surface is placed in three-dimensional space; the surface, containing the representation, is viewed through perspective projection; and the surface is manipulated to effect the reorganization of image details. The presentation transformation is separated into two steps: surface manipulation or distortion and perspective projection.

FIG. 1 is a graphical representation **100** of the geometry for constructing a three-dimensional ("3D") perspective viewing frustum **220**, relative to an x, y, z coordinate system, in accordance with known elastic presentation space (EPS) graphics technology. In EPS technology, detail-in-context views of two-dimensional ("2D") visual representations are created with sight-line aligned distortions of a 2D information presentation surface within a 3D perspective viewing frustum **220**. In EPS, magnification of regions of interest and the accompanying compression of the contextual region to accommodate this change in scale are produced by the movement of regions of the surface towards the viewpoint ("VP") **240** located at the apex of the pyramidal shape **220** containing the frustum. The process of projecting these transformed layouts via a perspective projection results in a new 2D layout which includes the zoomed and compressed regions. The use of the third dimension and perspective distortion to provide magnification in EPS provides a meaningful metaphor for the process of distorting the information presentation surface. The 3D manipulation of the information presentation surface in such a system is an intermediate step in the process of creating a new 2D layout of the information.

FIG. 2 is a graphical representation **200** of the geometry of a presentation in accordance with known EPS graphics technology. EPS graphics technology employs viewer-aligned perspective projections to produce detail-in-context presentations in a reference view plane **201** which may be viewed on a display. Undistorted 2D data points are located in a basal plane **210** of a 3D

perspective viewing volume or frustum **220** which is defined by extreme rays **221** and **222** and the basal plane **210**. The VP **240** is generally located above the centre point of the basal plane **210** and reference view plane ("RVP") **201**. Points in the basal plane **210** are displaced upward onto a distorted surface **230** which is defined by a general 3D distortion function (i.e. a detail-in-context distortion basis function). The direction of the viewer-aligned perspective projection corresponding to the distorted surface **230** is indicated by the line FPo - FP **231** drawn from a point FPo **232** in the basal plane **210** through the point FP **233** which corresponds to the focus or focal region or focal point of the distorted surface **230**.

EPS is applicable to multidimensional data and is well suited to implementation on a computer for dynamic detail-in-context display on an electronic display surface such as a monitor. In the case of two dimensional data, EPS is typically characterized by magnification of areas of an image where detail is desired **233**, in combination with compression of a restricted range of areas of the remaining information (i.e. the context) **234**, the end result typically giving the appearance of a lens **230** having been applied to the display surface. The areas of the lens **230** where compression occurs may be referred to as the "shoulder" **234** of the lens **230**. The area of the representation transformed by the lens may be referred to as the "lensed area". The lensed area thus includes the focal region and the shoulder. To reiterate, the source image or representation to be viewed is located in the basal plane **210**. Magnification **233** and compression **234** are achieved through elevating elements of the source image relative to the basal plane **210**, and then projecting the resultant distorted surface onto the reference view plane **201**. EPS performs detail-in-context presentation of n-dimensional data through the use of a procedure wherein the data is mapped into a region in an (n+1) dimensional space, manipulated through perspective projections in the (n+1) dimensional space, and then finally transformed back into n-dimensional space for presentation. EPS has numerous advantages over conventional zoom, pan, and scroll technologies, including the capability of preserving the visibility of information outside **234** the local region of interest **233**.

For example, and referring to FIGS. 1 and 2, in two dimensions, EPS can be implemented through the projection of an image onto a reference plane **201** in the following manner. The source image or representation is located on a basal plane **210**, and those regions of interest **233** of the image for which magnification is desired are elevated so as to move them closer to a

reference plane situated between the reference viewpoint **240** and the reference view plane **201**. Magnification of the focal region **233** closest to the RVP **201** varies inversely with distance from the RVP **201**. As shown in FIGS. 1 and 2, compression of regions **234** outside the focal region **233** is a function of both distance from the RVP **201**, and the gradient of the function describing the vertical distance from the RVP **201** with respect to horizontal distance from the focal region **233**. The resultant combination of magnification **233** and compression **234** of the image as seen from the reference viewpoint **240** results in a lens-like effect similar to that of a magnifying glass applied to the image. Hence, the various functions used to vary the magnification and compression of the source image via vertical displacement from the basal plane **210** are described as lenses, lens types, or lens functions. Lens functions that describe basic lens types with point and circular focal regions, as well as certain more complex lenses and advanced capabilities such as folding, have previously been described by Carpendale.

System. FIG. 3 is a block diagram of an exemplary data processing system **300** for implementing an embodiment of the invention. The data processing system is suitable for implementing EPS technology and for viewing detail-in-context presentations in conjunction with a graphical user interface ("GUI"). The data processing system **300** includes an input device **310**, a central processing unit or CPU **320**, memory **330**, and a display **340**. The input device **310** may include a keyboard, mouse, trackball, or similar device. The CPU **320** may include dedicated coprocessors and memory devices. The memory **330** may include RAM, ROM, databases, or disk devices. And, the display **340** may include a computer screen or terminal device. The data processing system **300** has stored therein data representing sequences of instructions which when executed cause the method described herein to be performed. Of course, the data processing system **300** may contain additional software and hardware a description of which is not necessary for understanding the invention.

GUI Using Detail-In-Context Lenses. According to an embodiment of the invention, the use of detail-in-context lenses for direct interaction with digital media and for interfacing with network portals is provided.

According to an embodiment of the invention, detail-in-context lenses act as portals or interfaces to networked and local sources of information including shopping networks, financial networks,

and local information sources, in the following manner. When a lens is placed over an area of interest, a user can interact with the lens directly either via a pointing device (such as a mouse or stylus) or a remote control device (such as a TV remote control or some other wireless controlling device such as a tablet or handheld computer).Using a lens in this instance allows a lens to be used during a TV show to view items of interest in much greater detail without ever leaving the show. In addition to viewing the item in much greater detail, in the present invention, the user can select and directly interact with the item of interest. For example, a TV viewer watching a show can view a watch that a celebrity is wearing in real-time and in much greater detail, without ever leaving the show. This interaction is much different than simply clicking on the watch and having a window popup with a stale picture of the watch. With the lens, a user views the exact item as it appears on screen in real time. Furthermore, the lens may move in real-time with the item it is associated with.

Using a remote controlling device, the user can directly control the lens and place it over different items of interest or have the lens scripted to move over different items. Multiple lenses can be used and controlled. In addition, using the lens interface, not only can the item of interest be viewed in greater detail but, additional details about the item can be viewed (for example, the brand, model, and price).

The present invention includes a mechanism to allow this watch to be purchased directly or placed in a "shopping cart" for later purchasing. The lens can also interface with stored user profiles. These profiles, which store user detials (eg. account and payment details), can be read by the lens to submit as identification to the shopping network. In addition to viewing details and interacting with details in digital media, the lens also serves as a highlighting medium to draw attention to items.

The lens in the present invention is not limited to simply television shows but can be used in other media such as DVDs and video games. For instance, a lens can move with the action in a soccer video game such that paid sponsors can have their banners in the background be highlighted and given attention as the game progresses.

The present invention may be used with Windows XP Media Center, for example, for: detail-in-context viewing of television programs; interaction with live television programs; and,

encouraging purchases within television programs without leaving the show; and, shopping within television shows and interfacing PDT with MSN Shopping via .NET Web Services. With the present invention, a user may: watch a favorite television show; view a watch worn by a favorite celebrity with great detail using PDT, within the context of television program; and, gain instant access to purchases via MSN and .NET Web Services with PDT lens interface and stored Passport profiles. For example, a user may use a remote control or tablet control to active PDT, clearly view an item of interest, and purchase the item via MSN Shopping, all without leaving the context of the show or its celebrities.

The present invention may also be used with gaming consoles such as Microsoft's Xbox. These gaming consoles are often positioned as general-purpose entertainment devices and may benefit from the application of PDT. For example, with respect to Xbox moving towards a more general-purpose home entertainment unit, PDT provides the following functionality gains: enables more powerful online collaboration and multiplayer gaming capabilities; digital image editing and management; interactive television/web browsing; interactive advertising; and, can work as a narrative/presentation tool or scripted communication tool.

With respect to Xbox information storage, cataloging, and data management, PDT provides the following functionality gains: digital image management; viewing of different content layers and overlays brought into the lens at various scales; and, more efficient navigation of "cluttered" information, cataloging of song titles, movie titles, etc.

With respect to Xbox image manipulation and presentation tools, PDT provides the following functionality gains: a powerful presentation tool that highlights area of interest; editing of images and models; and, 2D and 3D narration or scripting.

With respect to Xbox Product's Developer, Testing, Animation, Designer and Authoring Tools, appli d PDT functionality provides: efficient detail-in-context viewing and in-place editing workspace for people that are spatially restricted within their on-screen 2D and 3D workspaces; and, a presentation/communication tool to help create, modify, test, and inspect graphics for quality control purposes.

With respect to Xbox Product's video games to enhance gaming experience (i.e. Strategy Puzzle, First Person Shooter, Role Playing, Flight Simulator, Action/Adventure, etc.), applied PDT functionality provides: use of PDT for "cool" visual effects; increasing functionality of editing packages and tools used to create new worlds; adding to existing zooming and panning capabilities within games; and, an exciting new mode of co-located multiplayer and online multiplayer interactivity.

FIG. 6 is a screen capture illustrating the application of lenses in multi-player video games in accordance with an embodiment of the invention. With respect to Xbox Live and PDT for multi-player collarboration, PDT provides: an exciting new mode of co-located multiplayer and online multiplayer interactivity; cool new special effects that are ideal for enhancement of narrative capabilities, increasing the draw-in rate of first person shooter games to see further in front of view, and detail-in-context viewing for role playing games where players are required to be aware of their surroundings at all times; increased functionality of editing packages and tools available to create and explore new worlds; additions to existing zooming and panning capabilities; and, as games migrate to handsets and PDA's, PDT can aid in the change of content and display of games.

With respect to Xbox and advertising, for example, a scripted lens can move with the action to highlight advertising banners for paid sponsors. FIG. 5 is a screen capture illustrating a lens applied to advertisements (i.e. a "Yahoo" banner) in a video game in accordance with an embodiment of the invention. As the game player progresses towards the goal, sequential banners (i.e. the "NBA" and "Toshiba" banners) are magnified or hi-lited by the lens. In this way, the advertisements follow the game play. Alternatively, a selected banner may be stretched or deformed in the direction of play.

Data Carrier Product. The sequences of instructions which when executed cause the method described herein to be performed by the exemplary data processing system of FIG. 3 can be contained in a data carrier product according to one embodiment of the invention. This data carrier product can be loaded into and run by the exemplary data processing system of FIG. 3.

Computer Software Product. The sequences of instructions which when executed cause the method described herein to be performed by the exemplary data processin~ system of FIG. 3 can

be contained in a computer software product according to one embodiment of the invention. This computer software product can be loaded into and run by the exemplary data processing system of FIG. 3.

Integrated Circuit Product. The sequences of instructions which when executed cause the method described herein to be performed by the exemplary data processing system of FIG. 3 can be contained in an integrated circuit product including a coprocessor or memory according to one embodiment of the invention. This integrated circuit product can be installed in the exemplary data processing system of FIG. 3.

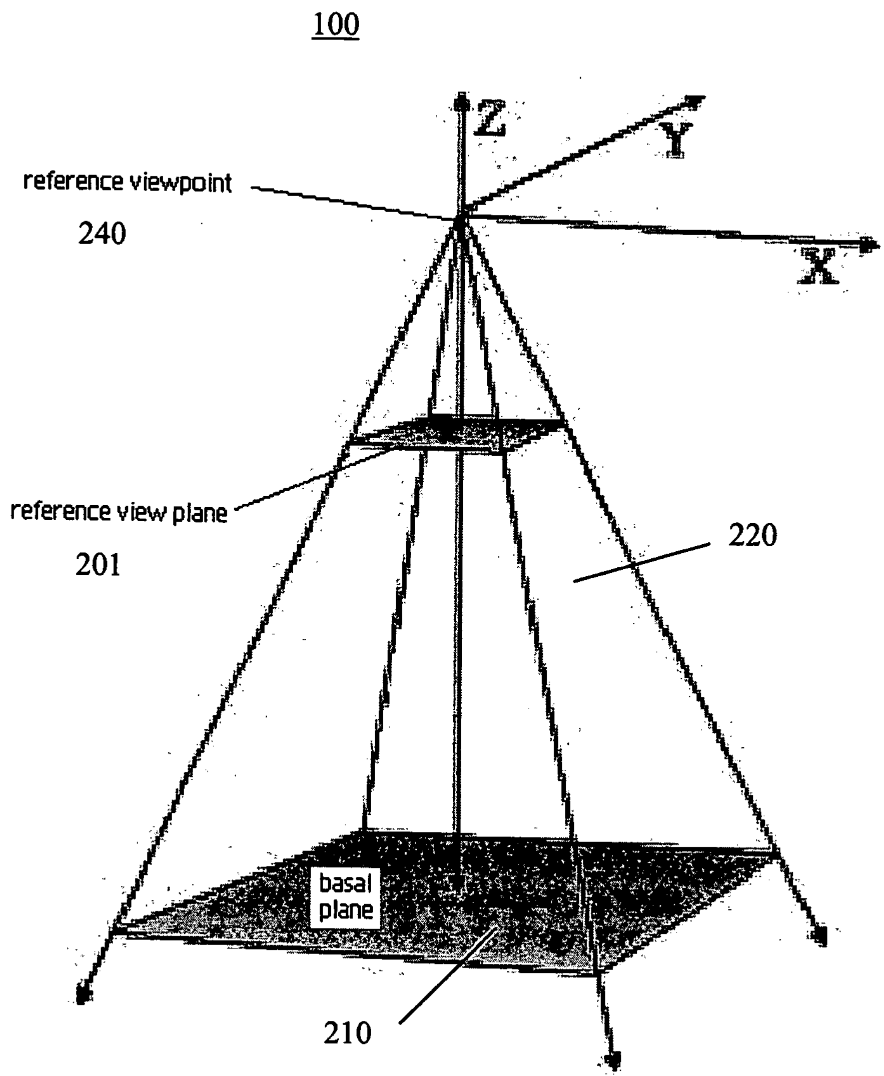
100
Z
Y
X
reference viewpoint
240
reference view plane
201
220
basal
plane
210

FIG. 1

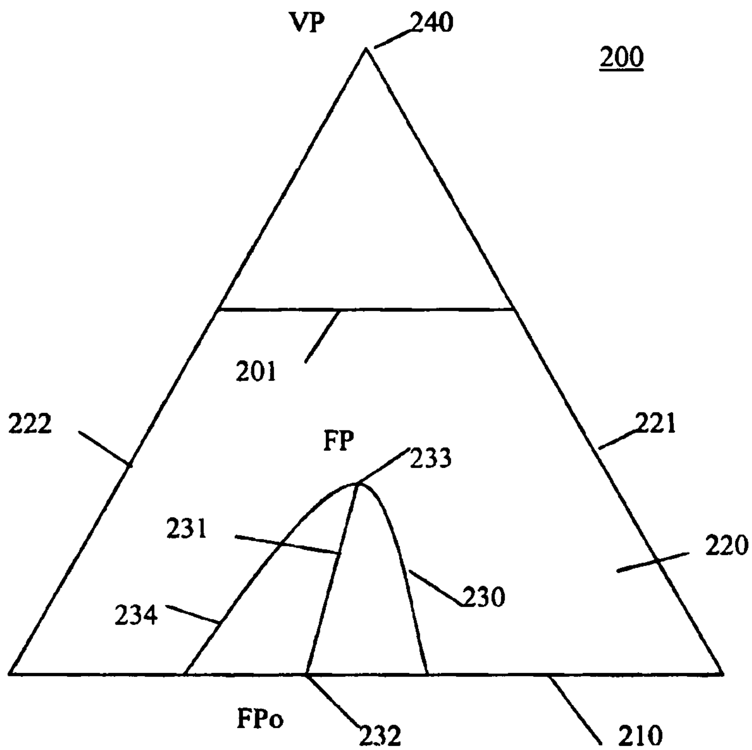

FIG. 2

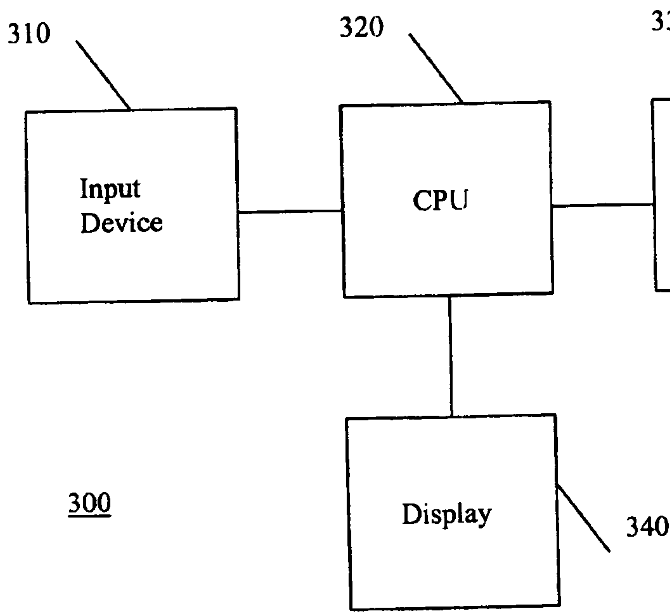

FIG. 3

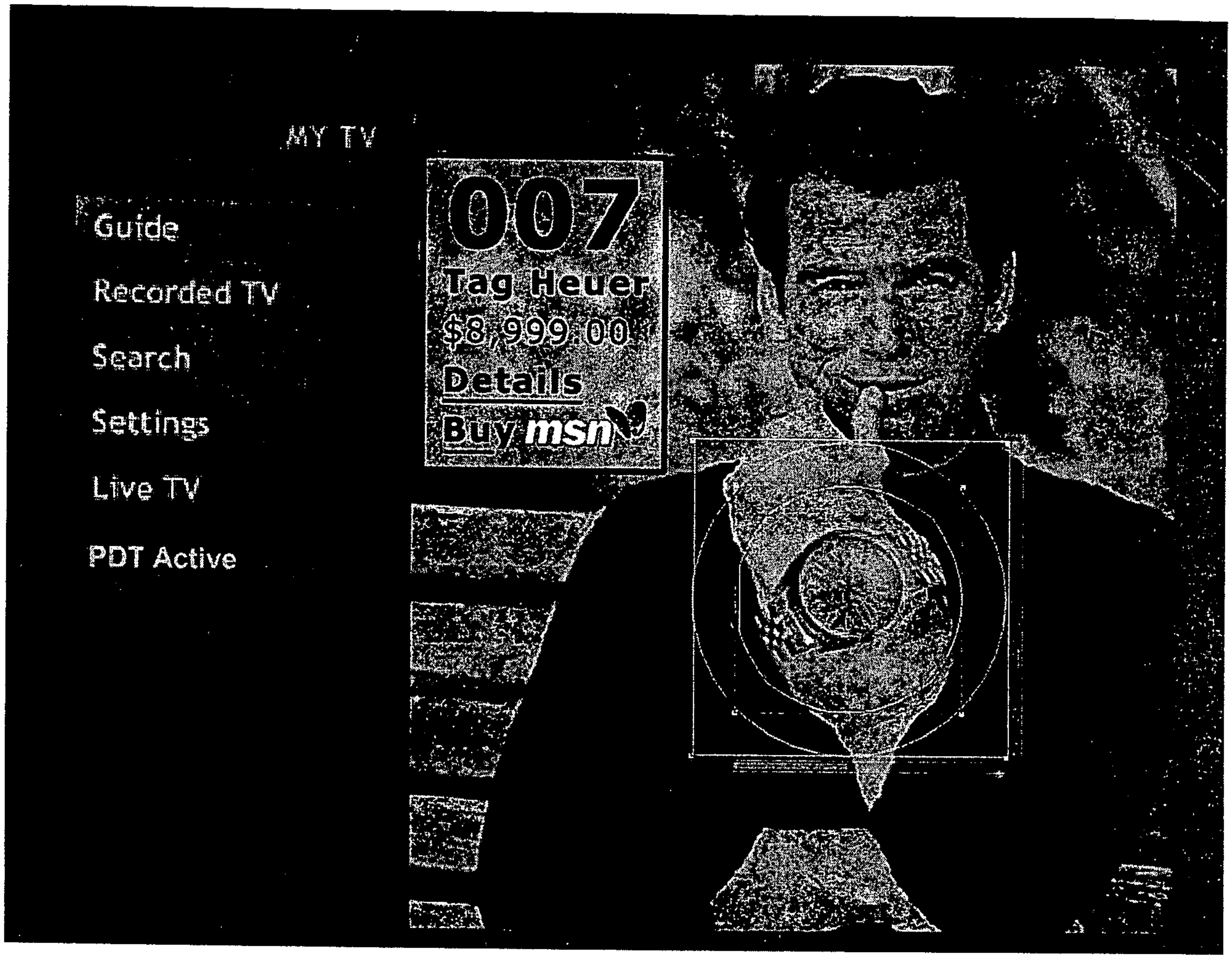
MY TV
Guide
Recorded TV
Search
Settings
Live TV
PDT Active
007
Tag Heuer
$8,999.00
Details
Buy msn

FIG. 4

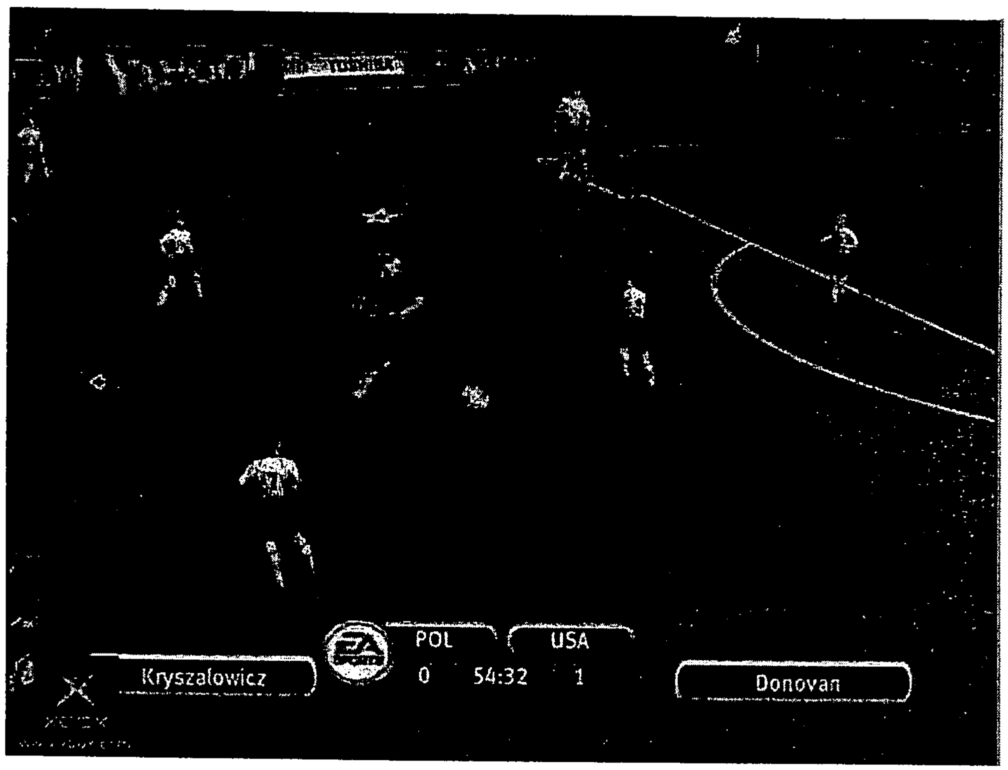

FIG. 5

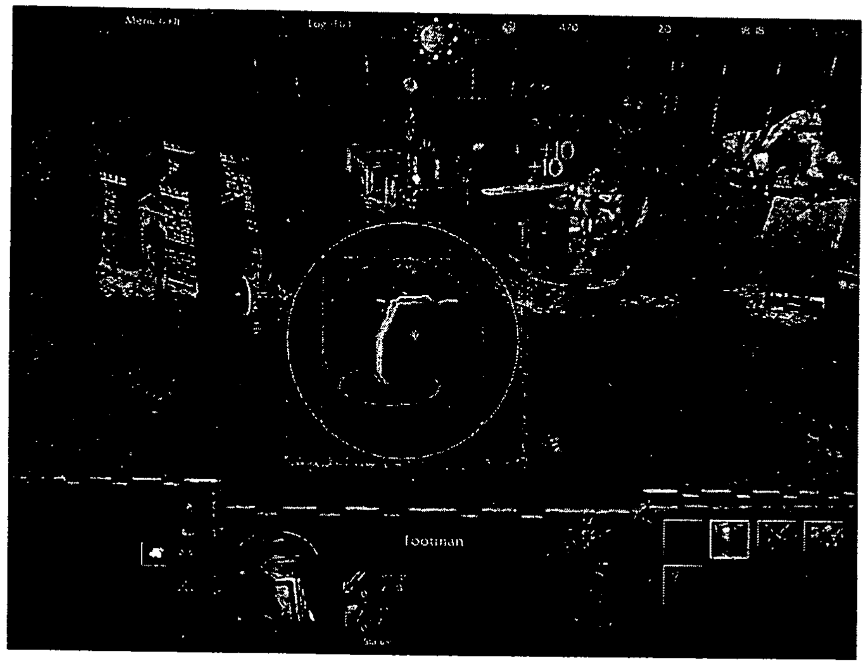

FIG. 6